Water Management Plan

United States Environmental Protection Agency
Andrew W. Breidenbach Environmental Research Center
26 West Martin Luther King Drive
Cincinnati, Ohio 45268

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Point of Contact:
Richard D. Koch
Director, Facilities Management and Services Division
513-569-7902

EPA

United States Environmental Protection Agency
Andrew W. Breidenbach Environmental Research Center
Cincinnati, Ohio

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Approved by:

Richard D. Koch, Director, Facilities Management and Services Division — Date 7/12/04

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1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

In order to meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water must be sustainable and renewable. Sound water resource management, which emphasizes careful, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As we face increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can also prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order 13123, Greening the Government Through Efficient Energy Management.

This Water Management Plan has been established to document and promote the efficient use of water at the U.S. EPA Andrew W. Breidenbach Environmental Research Center located in Cincinnati, Ohio. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines under Executive Order 13123.

2.0 FACILITY DESCRIPTION

The Andrew W. Breidenbach Environmental Research Center (AWBERC) is located on 22 acres donated by the City of Cincinnati, adjacent to the main campus of the University of Cincinnati and a near a major hospital and medical research complex. The ten-story facility opened in 1976 and is owned and operated by EPA.

Internationally recognized for water research, the center has also become a leader in bioremediation, pollution prevention, and superfund research. Through this Center, EPA also provides public education and training on the environment and emergency response. The Center is one of two major EPA research centers in the United States, and houses state-of-the-art research laboratories, training facilities, and administrative offices.

Research activities of several EPA national laboratories are conducted at AWBERC, including the National Exposure Research Laboratory, the National Risk Management Research Laboratory, the National Homeland Security Research Center, and the National Center for Environmental Assessment.

AWBERC contains laboratory spaces equipped for chemistry and biology research, including animal containment rooms and an aquatic culture unit. Laboratory spaces are interspersed with office and general use space throughout the 10 story building. Boilers, chillers, air handlers, and other main mechanical equipment are located in a basement mechanical room. A 3,000 ton condenser water cooling tower is located in a below grade cut-out on the east side of the main building. Two additional cooling towers are mounted on the roof to provide year-round, recirculated cooled water to equipment located throughout the building. A one story full containment laboratory is located adjacent to the main building, on the north side.

A three story annex building is currently under construction on the north west corner of the main building. The annex, scheduled for occupancy in late 2004, will provide additional office space and allow some of the space in the main building currently occupied by offices to be converted to research laboratories. The main building, containment laboratory, and annex building contain 380,039 square feet of conditioned space.

3.0 FACILITY WATER MANAGEMENT GOALS

The water management goals of AWBERC are achieved through the implementation of an Environmental Management System (EMS). The EMS has been established and is being implemented consistent with EPA's Office of Administration and Resources Management environmental management policy for EPA-Cincinnati. The environmental policy statement and EMS aspects and targets related to water management are included in the following sections.

Environmental Policy Statement

The Office of Administration and Resources Management (OARM) is committed to giving our employees and others at our site a safe environment. The health and welfare of those who work at EPA-Cincinnati is a top priority, and is an integral part of our mission to protect the environment and serve the American public. Our Safety, Health, and Environmental Program (SHEMP) is designed to ensure the integrity of our commitment through the following principals:

Compliance

We will meet and/or exceed regulatory compliance standards, and increase our current programs to assure compliance. To achieve our goal of meeting and exceeding compliance, we will promote environmental awareness among our employees through training, and expect every employee to take responsibility for fulfilling environmental objectives. Further, we will inform our vendors, suppliers, and contractors of our environmental requirements, and encourage them to comply with similar policies. We will favor vendors who operate with sound environmental principles.

Prevention

We will foster the sustainable use of our local natural resources by preventing pollution, reducing waste, and recycling. Whenever possible, we will do so through source reduction. We will insist on safe operating procedures, intelligent recycling/disposal of waste, and we will be fully prepared for emergencies that threaten these standard operational procedures.

Environmental Stewardship

We are EPA, and we will set the example for others to follow. We will demonstrate our commitment to reduce/reuse/recycle, and will share our success stories with others. As a community member and leader, we will strive to teach by doing - our work will be a model for others, and we will share our experience locally and broadly.

Continual Improvement

We will seize opportunities to go beyond defined requirements and adapt to changing situations and emerging concerns. We will lead by example, self-correct, and share our lessons with others.

Targets

In view of this environmental policy, EPA-Cincinnati has identified water consumption as a significant environmental aspect and has established the following objectives and targets related to this aspect:

Objective	**Target**
Investigate methods to reduce the volume of potable water consumed at each of the Cincinnati facilities.	Establish a baseline for monthly water consumption using City of Cincinnati utility bills and develop a water balance for operations. Baseline consumption and water balance data will be compared to determine if additional water consuming operations have not been considered. Both the baseline water consumption and water balance for each EPA facility in Cincinnati will be completed by the end of calendar year 2003.
	Explore the potential water savings that could be achieved by the installation of low-flow toilets and shower heads by Spring 2004.
Decrease wastewater discharges from HVAC system.	Investigate methods to increase recycling in cooling towers and utility boilers using alternative treatment chemicals by Spring 2004

4.0 UTILITY INFORMATION

Contact Information

Potable water is provided by:

City of Cincinnati
Greater Cincinnati Water Works
4747 Spring Grove Avenue
Cincinnati, Ohio 45232

Phone: 513-591-7700

Sewage service is provided by:

Metropolitan Sewer District of Greater Cincinnati
1600 Gest Street
Cincinnati, OH 45204

Phone: 513-352-4900

Rate Schedule

Monthly water billing is based on a tiered rate structure, provided in Table 1.

Table 1
Water Use Fee Structure
(effective 16 January 2004)

Monthly amount	Rate per 100 cubic feet (ccf)
0 to 20 ccf	$1.39
20 to 600 ccf	$1.13
Over 600 ccf	$1.01

The utility also charges AWBERC a fixed rate of $123.75 per month for installed water meters.

The monthly billing for sewer use is also on a tiered rate structure, provided in Table 2.

Table 2
Sewer Use Fee Structure
(effective 9 January 2004)

Monthly amount	Rate per 100 cubic feet (ccf)
0 to 5 ccf	Flat fee of $20.45/day
5 to 50 ccf	$2.425
Over 50 ccf	$1.939

The sewer use fee is based on total metered water usage, minus water used for systems that introduce little to no pollutant load to the sewer. The quantity of flow subtracted from the total water use is based on sewage deduct meters installed on the following equipment water supply lines: three cooling tower make-up water lines, the emergency generator, boiler make-up, vacuum pumps, and lab air compressors. The sewage authority has indicated a desire to phase out the sewage use deduction over time. As of September 2003, AWBERC was receiving credit for approximately 85 percent of the flow registered on the sewage deduct meters.

The storm water fee is $12.47 per day.

Payment Office

Research Triangle Park Finance Center (RTP-FC)

(Pouch and Regular Mail)
Environmental Protection Agency
Mail Code - D143-02
Research Triangle Park, NC 27711

(FEDEX)
Environmental Protection Agency
Mail Code - D143-02
4930 Page Road
Research Triangle Park, NC 27711

The fax number for RTP-FC is: 919-541-4975

5.0 FACILITY INFORMATION

AWBERC is a diversified environmental research center with a mixed use office and laboratory space. Laboratory activities span a range of chemical and biological disciplines, and the facility houses small mammal rooms and an aquatic culture system to support research activities. Water uses include potable water and high-purity deionized water supplied for laboratory purposes, water supplied to building mechanical systems, and domestic water used in the kitchen and for building sanitation. The facility has discontinued the use of its irrigation system; therefore, virtually no water is used for landscape irrigation.

Major Water Using Processes

Estimates of water consumption by major use area are provided in Table 3. These data reflect average water use during FY 2003.

Measurement Devices

Incoming city water supply is metered. Flow totalizing meters are also installed on many of the major subsystem flows. An inventory of metered flows (with meter number) is provided below:

- City water supply
- Cooling tower make-up, main (S01001)
- Cooling tower make-up, roof #1 (S02433)
- Cooling tower make-up, roof #2 (S02432)
- Boiler make-up (S01991)
- Air compressor cooling (S02387)
- Vacuum pumps (S02383)
- Emergency generator cooling (S01560)
- Aquatic culture water (not numbered)

Flow totalizer readings are recorded monthly and reported to the facilities management staff. Water use trends are monitored on an ongoing basis and unexpected changes in water use are investigated and resolved.

Shut-off Valves

City water supply line shutoffs are located in the main mechanical room on the basement level.

Occupancy and Operating Schedules

Approximately 850 employees work at AWBERC. The facility operates on a flex time schedule and is typically occupied between 6:00 a.m. and 6:00 p.m., Monday through Friday.

Table 3
Major Water Using Processes, AWBERC

Major Process	Annual Consumption (gallons)	Percent of Total	Comments
Sanitary	5,300,000	26.5	Engineering estimate
Cooling tower (main)	4,638,000	23.2	Metered total
Cooling tower (roof #1)	449,000	2.2	Metered total for 5 months, extrapolated to full year
Cooling tower (roof #2)	408,000	2.0	Metered total for 5 months, extrapolated to full year
Boiler make-up	2,578,000	12.9	Metered total
Air compressor cooling	1,697,000	8.5	Metered total for 5 months, extrapolated to full year
Vacuum pump seal water	208,000	1.0	Metered total for 5 months, extrapolated to full year
Kitchen ice maker cooling	300,000	1.5	Based on instantaneous measurement of 0.6 gal/min Assumes cooling flow runs 24hr/day
Emergency generator cooling	4,900	<1	Metered total
Aquatic culture water	2,270,000	11.3	Metered total for 5 months, extrapolated to full year
Animal cage washer	270,000	1.3	Engineering estimate
Animal room washdown	20,000	<1	Engineering estimate
Reverse osmosis reject water	82,000	<1	Based on instantaneous flow measurement and run time meter
Miscellaneous laboratory and other uses	1,779,100	8.9	Calculated as remaining difference from metered total
TOTAL	20,004,000	100.0	Metered total city supply

Additional detail on assumptions and calculations supporting these water use estimates are provided in Appendix A.

6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS

The Federal Energy Management Program (FEMP) has identified water efficiency improvement Best Management Practices (BMPs) in ten possible areas. Implementation of BMPs in four or more areas are required under FEMP guidance. AWBERC has adopted and will maintain BMPs in nine of the ten areas, as indicated by the check marks below:

- ✓ Public Information and Education Programs
- ✓ Distribution System Audits, Leak Detection and Repair
- ✓ Water Efficient Landscape
- □ Toilets and Urinals
- ✓ Faucets and Showerheads
- ✓ Boiler/Steam Systems
- ✓ Single-Pass Cooling Systems
- ✓ Cooling Tower Systems
- ✓ Miscellaneous High Water-Using Processes
- ✓ Water Reuse and Recycling

Public Information and Education Programs (BMP #1)

AWBERC promotes water conservation and awareness using the EPA laboratory "Every Drop Counts...Count Every Drop!" water conservation poster series. Conservation posters are displayed in prominent locations within the building. AWBERC also promotes environmental awareness of facility operations through an Environmental Excellence Team that conducts employee outreach through presentations and periodic emails. Recent examples of employee education on water conservation topics include a speaker on natural landscaping and a presentation on use of cooling towers to eliminate single-pass cooling water. The Environmental Excellence Team will continue to address water conservation topics of interest in the future. In addition, employees are also being educated on water and other resource conservation topics though the implementation of the EMS for EPA-Cincinnati.

Distribution System Audits, Leak Detection and Repair (BMP #2)

A screening level system audit was conducted in November 2003 and known water uses account for greater than 90 percent of water consumption.

Water supply piping within the facility is exposed and accessible. Facility staff are trained to report leaks and malfunctioning water using equipment to a facility maintenance trouble desk. Reported problems are assigned a work order, which is completed by the facility operation and maintenance (O&M) contractor.

Water Efficient Landscape (BMP #3)

AWBERC is located on a 22 acre, park-like setting in the City of Cincinnati. The area surrounding the facility structures is primary covered with turf grass, interspersed with trees and shrubs. Irrigation of turf areas was stopped several years ago, when AWBERC staff decided relying on natural precipitation was the most environmentally sound approach to landscape management and the example they wanted to set for the community. Turf grass is allowed to go dormant during dry summer months; growth returns with cooler, wetter weather. Planters surrounding the facility entrance are watered with hand-held watering devices.

Toilets and Urinals

Toilets and urinals throughout the building are primarily those installed during original construction during the mid 1970s. As such, they are the older, higher flow design, with flow rates estimated to be approximately 5 gallons per flush (gpf). Given the relatively large working population within the building (850 employees), and the fact that domestic water for sanitary use is the largest identified water uses within the facility, sanitary fixture upgrades to water efficient designs (1.6 gpf toilets and 1.0 gpf urinals) will be considered as an important part of any restroom renovation project undertaken. Currently, the building contains approximately 56 toilets and 20 urinals of the older style designs. Best management practice status can be achieved in this area by upgrading the older style toilets and urinals to water-efficient designs.

Rest rooms installed in the pathology containment area and women's locker room, and the American with Disabilities Act compliant rest room on the ground floor are equipped with water efficient fixtures (7 toilets, 1 urinal total).

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected by the O&M contractor.

Faucets and Showerheads (BMP #4)

Water-efficient, 2.0 gallon per minute (gpm) lavatory faucets and water-efficient shower heads (2.5 gpm) have been installed throughout AWBERC to conserve water. System pressure is maintained between 20 to 80 pounds per square inch, within the range recommended for optimum system performance.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected by the O&M contractor.

Boiler/Steam Systems (BMP #5)

The boiler water system is monitored and maintained every two weeks under a service contract to prevent system scale and corrosion and to optimize condensate reuse. Boiler water quality parameters

such as sulfite, hardness, conductivity, alkalinity, pH, and iron are monitored and controlled though periodic testing and chemical treatment provided by a service contractor. System components are visually inspected several times each day by the boiler operator. Approximately 80 to 85 percent of steam condensate is captured and returned to the boiler system.

Single Pass Cooling Equipment (BMP #6)

Since 1990, AWBERC has made a concentrated effort to significantly reduce the use of potable water for single pass cooling. Prior to that date, single pass water was used for condenser cooling water on auxiliary cooling units on environmental chambers, freezers, the computer room, and laboratory spaces throughout the facility with concentrated heat loads. A 100 ton roof-top cooling tower was installed in 1990, and a second, 150 ton roof-top cooling tower was installed in 1998 to provide year-round recirculated cooled water. The availability of recirculated cooled water has allowed the facility to eliminate most applications of single pass cooling, thereby reducing total facility water consumption by over 80 percent.

Single pass cooling is still in use on the air compressors in the basement mechanical room, and the kitchen ice maker. While best management practice status is claimed based on the significant progress in this area already achieved, the two remaining uses of single pass cooling water will be examined to determine if cost effective alternatives can be implemented.

Cooling Tower Systems (BMP #7)

The AWBERC facility is equipped with three cooling towers, a main 3,000 ton unit which provides condenser water cooling for the building chillers, and two roof-top units (100 and 150 tons) which provide recirulating condensing water for the computer room, environmental chambers and approximately 45 packaged air conditioning units located throughout the building. The main cooling tower is taken out of service during the winter when the chillers are not operating. The two roof top units operate year round. All three cooling towers are maintained and operated with water conservation as a priority.

The water treatment on the main cooling tower was converted from a traditional chemical treatment regime to magnetic treatment for the 2003 cooling season. The magnetic process is designed to change the surface charge on suspended particles and allow them to coagulate and be removed in a cyclone separator. While the effectiveness of the magnetic process on this cooling tower is still being evaluated, results to date have been satisfactory. The magnetic process has allowed the facility to increase the cycles of concentration on the main cooling tower loop. A cooling tower system quality and performance review is conducted every two weeks by service contractor. A conductivity meter is used to automatically control cooling tower blowdown at between 3,600 and 4,000 *u*S/cm. This conductivity control range provides for over 10 cycles of concentration and very efficient cooling tower water use.

The two roof-top units are also equipped with magnetic water treatment systems, in the one case since the tower was installed in 1990. In part, the long history of satisfactory operation of these systems

convinced facility staff to convert the main tower to magnetic treatment as well. Cooling tower water chemistry on these two towers is monitored monthly by the O&M contractor and the blowdown frequency is manually adjusted based on those results. The conductivity target for these two towers is 1,800 *u*S/cm. This conductivity target provides for approximately five cycles of concentration and efficient cooling tower water use.

Miscellaneous High Water-Using Processes (BMP #8)

Approximately four to five gallons per minute of city water is conditioned and used as water supply to the aquatic culture system. The water flow rate to each tank is calibrated monthly and controlled to minimize water use, while maintaining the required level of water exchanges per hour and dissolved oxygen in each tank. Careful flow control to minimize water use is considered a best management practice in this area.

Water Reuse and Recycling (BMP #9)

AWBERC is equipped with three animal cage washers that operate in batch mode. Each washer has a wash cycle, rinse cycle, and final rinse cycle. The washers are set up to reuse final rinse water as wash water for the next batch, saving approximately 80,000 gallons of water annually.

7.0 DROUGHT CONTINGENCY PLAN

The City of Cincinnati does not have a water management plan specifically for droughts. However, as conditions warrant, AWBERC is prepared to follow the water use recommendations and restrictions outlined under the State of Ohio Drought Response Plan. Key recommendations of this plan are summarized below. Ohio has defined four levels of drought response: normal phase, alert phase, conservation phase, and emergency phase.

Normal Phase:

In this phase, water supplies are adequate and climatological conditions are normal. Recommended action is to develop water conservation measures and a water recycling program. Appropriate conservation and recycling measures at AWBERC are addressed by this plan.

Alert Phase:

Climatological data indicates above normal temperatures and below normal precipitation for an extended period. Streamflow, reservoir levels, and/or groundwater levels are below normal over an extended period of time. Recommended action is to activate conservation measures and reduce water for nonessential uses, such as fountains, landscape watering, and washing of motor vehicles.

Conservation Phase:

Climatological conditions worsen and water levels continue to decline. Water conservation measures are increased and all nonessential uses are eliminated.

AWBERC strives to operate at a level consistent with the conservation phase as part of its routine operating practice. Water is not used for nonessential purposes such as landscape irrigation, decorative fountains, and motor vehicle washing.

Emergency Phase:

Climatological conditions continue to worsen and water levels continue to diminish. Conservation measures have to be more stringent to ensure adequate water supply for health and sanitary purposes. Recommended action is to reduce operational levels so that a water use reduction goal of 30 percent can be achieved.

If a conservation phase drought is declared in the greater Cincinnati water management district, the Director of the Facilities Management and Services Division will convene a meeting with the Director of each ORD research laboratory operating at AWBERC to identify modifications to facility operations that could be implemented to achieve emergency phase reductions. Operational changes will be implemented as necessary to meet declared emergency phase water use restrictions.

Additional information on the Ohio Drought Response Plan can be found at:

http://www.epa.state.oh.us/ddagw/Documents/droughtactions.pdf

8.0 COMPREHENSIVE PLANNING

The Director of the Facilities Management and Services Division will ensure that water supply, wastewater generation, and water efficiency BMPs are taken into account during the initial stages of planning and design for any facility renovations or new construction. This will be accomplished by including water efficiency as a design objective in purchase orders issued to the project Architectural/Engineering firm. These factors will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption. To achieve this objective, the Project Officer for the facility O&M contract will consider the impact on facility water use when reviewing and approving work orders for installation of new equipment.

9.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

AWBERC is pursuing the following projects to achieve additional reductions in water use:

1) Upgrade Toilets and Urinals. AWBERC will replace originally installed toilets and urinals with water efficient models as part of a restroom renovation project planned to occur in one to two years, pending approved funding. Up to 56 toilets and 20 urinals could be upgraded. At an installed cost of $500 per fixture, simple payback on each fixture upgraded is approximately 4 years, at current water and sewer rates. Total annual savings are projected to be 2,700,000 gallons and $10,600. If urinals are upgraded, a waterless design will be considered. Waterless urinals can be installed for approximately the same cost as flush units, and eliminate the use of flush water. Waterless urinals would result in additional annual savings of 320,000 gallons and $1,200 in water and sewer costs.

2) Eliminate Single Pass Cooling. Single pass cooling is currently applied to the two air compressors in the basement mechanical room, and the ice maker in the kitchen. In each case, an engineering study will be undertaken to determine if it is cost effective to eliminate this use by either routing the recirculated cooled water supply to these points of application, or replacing the equipment with air cooled models. Potential savings from eliminating single pass cooling on the air compressors is 1,700,000 gallons and $6,700 per year if the sewer use deduction is eliminated or $2,300 per year if the deduction remains in effect. Total water consumption for ice maker cooling should be verified before potential cost savings can be estimated.

APPENDIX A
WATER BALANCE SUPPORTING CALCULATIONS

AWBERC, Cincinnati, Ohio

Major Process	Annual Consumption (gallons)	Supporting Calculations
Sanitary	5,300,000	Engineering estimate. Based on 25 gallons per person per day. Assume 850 people and 250 operating days. (850 people * 25 gal/person-day * 250 days/year) = 5,300,000 gallons
Cooling tower (main)	4,638,000	Metered total (6200 ccf * 748.05 gal/ccf = 4,638,000 gallons)
Cooling tower (roof #1)	449,000	Metered total for April to September, extrapolated to full year (250 ccf * 12months/5months * 748.05 gal/ccf = 449,000 gallons)
Cooling tower (roof #2)	408,000	Metered total for April to September, extrapolated to full year (227 ccf * 12months/5months * 748.05 gal/ccf = 408,000 gallons)
Boiler make-up	2,578,000	Metered total (3446 ccf * 748.05 gal/ccf = 2,578,000 gallons)
Air compressor cooling	1,697,000	Metered total for April to September, extrapolated to full year (945 ccf * 12months/5months * 748.05 gal/ccf = 1,697,000 gallons)
Vacuum pump seal water	208,000	Metered total for April to September, extrapolated to full year (116 ccf * 12months/5months * 748.05 gal/ccf = 208,000 gallons)
Kitchen ice maker cooling	300,000	Based on instantaneous measurement of 0.6 gal/min (0.6 gal/min*60min/hr*24hr/day*365day/year = 300,000 gal). Assumes cooling flow runs 24hr/day
Emergency generator cooling	4,900	Metered total
Aquatic culture water	2,270,000	Metered total for 25 June 2003 to 18 Nov 2003, extrapolated to full year (909,518 gallons *365days/146days = 2,270,000 gallons)
Animal cage washer	270,000	Estimated at 5,200 gal/week*52 weeks = 270,000 gallons per year
Animal room washdown	20,000	Estimated at 2 gal/min*60min/hr*1hr/day*130days/year = 20,000 gallons

APPENDIX A
WATER BALANCE SUPPORTING CALCULATIONS (CONTINUED)

AWBERC, Cincinnati, Ohio

Major Process	Annual Consumption (gallons)	Supporting Calculations
Reverse osmosis reject water	82,000	Based on instantaneous flow measurement of 2.6 gal/min and run time meter reading of 23 hours between 3 November to 19 November 2003, extrapolated to full year (2.6 gal/min*60 min/hr*23 hour/16days*365day/year = 82,000 gallons)
Miscellaneous laboratory and other uses	1,779,100	Calculated by difference: 20,004,000 total gallons - 18,224,900 gallons other accounted for uses = 1,779,100 gallons
TOTAL	20,004,000	Metered total